HP 3708A
Noise and Interference Test Set

HEWLETT PACKARD

Product Note 3708-4: Demonstration Guide
How to win with the HP 3708A

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Name: _____

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Introduction

This demonstration guide shows you in simple terms how to use the HP 3708A Noise and Interference Test Set both with and without the software.

It also gives instructions in the use and explanation of the new software for the instrument, and shows how to demonstrate this software easily.

Leave this guide with customers who want to evaluate the instrument for themselves after you've done the demonstration, so they can see how powerful the instrument is in fulfilling their testing requirements.

Figure 1 shows the instrument:

Figure 1 The HP 3708A Noise and Interference Test Set

Customer Qualification

Customers who design, manufacture and use digital microwave radio, satellite, military, cellular and LAN systems benefit from using the HP 3708A.

Customer Presentation

This document gives you the tools to make the presentation easier. It is clearly laid out and provides the information you need, presented in the way you need it.

Demonstration Guide Tour

1. If you're sitting in the car outside the customer's door . . .

    Read sections 1.1, 1.3, 1.4 and 1.5.

2. If you have to meet the customer this afternoon . . .

    Read pages 6 to 27

3. If you want to get to know the instrument well . . .

    Read the full demonstration guide - it makes interesting reading.

4. If you don't know anything about the instrument . . .

    Refer to the following Product Notes:

    Product Note 3708-1 - 'Noise and Interference Effects in Microwave Radio Systems'.
    Publication Number - 5953-5487

    Product Note 3708-2 - 'Using the HP 3708A on Microwave Radio Systems'.
    Publication Number - 5953-5489

    Product Note 3708-3 - 'Determination of Residual Bit Error Ratio in Digital Microwave Systems'.
    Publication Number - 5953-5490

    Product Note 3708-5 - 'Testing Satellite Systems with the HP 3708A'.
    Publication Number - 5954-9555

    ...then read this guide.

This guide shows you how to demonstrate the hardware on a digital radio system. If a radio isn't available, this guide shows you how to demonstrate the HP 3708A with a radio simulator.

In each of the hardware demos, the software makes it easier. Contained within the software is a demonstration pack. By pressing only a few keys, HP 3708A demonstration becomes quick and easy.

This Demonstration Guide also describes full operation and use of the software.
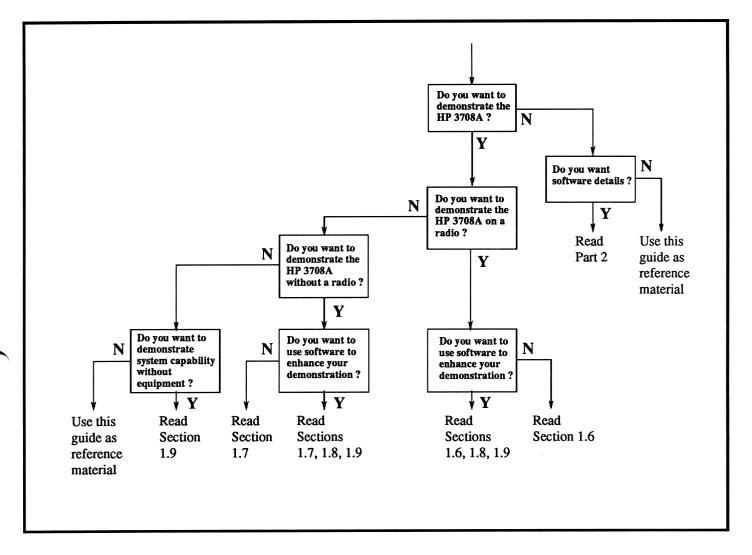
NOTE: Use this guide with Product Note 3708-2 'Using the HP 3708A on Microwave Radio Systems' Publication Number 5953-5489. This describes general connection and operation of the HP 3708A with digital radio systems.

Why should I sell the HP 3708A Noise and Interference Test Set?

The HP 3708A helps you win. This instrument is versatile enough to meet the needs of digital radio and other system testing; in R&D, manufacturing, installation/commissioning, acceptance testing and maintenance.

The HP 3708A provides a more accurate and cost-effective way of testing than with any other methods, and the competitive price gives customers low cost of ownership.

How to use this guide

Do you want to demonstrate the HP 3708A ?
— **N** →
Do you want software details ?
— **N** → Use this guide as reference material
— **Y** → Read Part 2

Y

Do you want to demonstrate the HP 3708A on a radio ?
— **N** →
Do you want to demonstrate the HP 3708A without a radio ?
— **N** →
Do you want to demonstrate system capability without equipment ?
— **N** → Use this guide as reference material
— **Y** → Read Section 1.9

Y

Do you want to use software to enhance your demonstration ?
— **N** → Read Section 1.7
— **Y** → Read Sections 1.7, 1.8, 1.9

Y

Do you want to use software to enhance your demonstration ?
— **Y** → Read Sections 1.6, 1.8, 1.9
— **N** → Read Section 1.6

This document divides into two parts:

Part 1 Shows demonstrations to different customer types, with and without software.

Part 2 Gives details about the new demonstration software for the HP 3708A and specific details of software operation.

Part 1

Contents

1.1 What is the HP 3708A and what does it do for me?

The HP 3708A Noise and Interference Test Set is a noise source and a power meter contained in the same instrument. Used seperately, these components are useful, but used as an integrated package, they provide many benefits. The HP 3708A is easy to use, with simple connection to the radio IF section, and is easy to demonstrate, either manually, or with the software.

Main features

- Provides accurate C/N and C/I ratios, under any conditions
- Wide operating range - tests systems over 10 to 200 MHz frequency range
- Easy operation under processor control
- Quick and easy measurements - using the HP 3708A in making measurements

Main benefits

- Saves measurement time
- Performs accurate, repeatable measurements under most conditions

1.2 What is the software and what does it do for me?

The HP 3708A Demonstration Software integrates operation of the HP 3708A and a pattern generator/error detector to provide automated measurements. It does more besides - it improves overall testing quality, allows unattended operation, and provides features which improve testing.

Main features

- Accommodates the latest HP BER test sets
- Storage and retrieval of measurement curves and equipment configurations
- Result manipulation and hard copying permit archiving, or later analysis
- Autosequencing provides unattended operation

Main benefits

- Easy measurement operation by operators with minimal training
- Repeatable, consistant measurements
- Saves money - provides faster digital radio performance measurements than manual operation

1.3 Demonstrating the HP 3708A to R&D

R&D labs use the HP 3708A to test digital radio and satellite systems because of its high level of accuracy. Promote the key features listed below:

☐ Accurate and repeatable C/N and C/I ratio measurements characterize modem and radio performance in the design phase.

☐ Versatile feature set provides different parameter display, and can accommodate different filter designs

☐ High performance noise source and power meter accurately characterizes noise bandwidth

☐ Automatic conversion between C/N, C/No, and Eb/No to satisfy specific requirements.

R&D require accurate measurements to assess radio performance. They also require a comprehensive feature set to allow assessment of different components in the radio system design. The HP 3708A provides this and much more, in one integrated package.

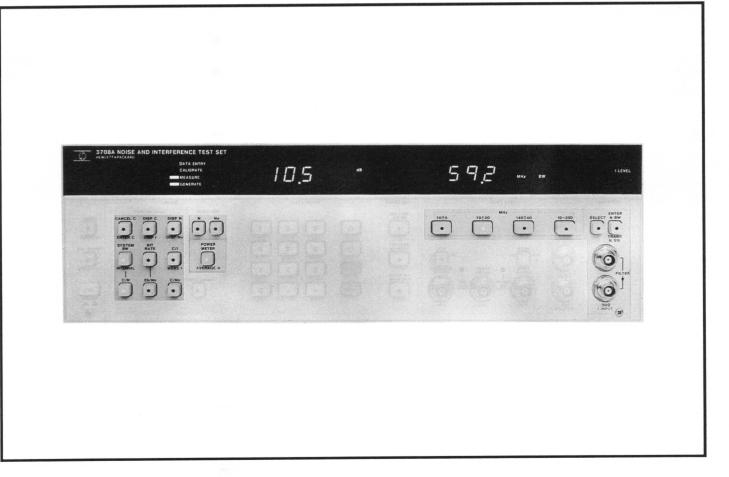Demonstrate the key areas shown in the figure:

Figure 2 Key areas of the HP 3708A for demonstration to R&D

Place emphasis on measurement accuracy and repeatability, the comprehensive feature set, and instrument versatility. For digital radio, satellite systems, and other testing areas in the design phase.

(a) C/N, C/No and Eb/No ratio tests

C/N ratio vs BER tests form the main tests performed by development labs. In addition, they may want to perform C/No or Eb/No ratio vs BER measurements to test satellite or other narrow bandwidth systems. The HP 3708A provides quick and simple conversion between the measurements, with the same accuracy as C/N ratio measurements.

(b) Easy external filter capability

Development labs want to test new radio designs with a variety of different filters before they select one which gives them best performance. The HP 3708A helps in this area. The instrument provides external filter operation over the 10-200 MHz range, and provides accurate testing with any filter.

(c) Integral noise bandwidth measurement capability

The HP 3708A performs noise bandwidth measurements without any external test equipment. External filter operation requires noise bandwidth measurements.

(d) Other features within the HP 3708A

Most instrument features are useful in R&D. Quick shifting between display of carrier, noise and interference levels provides information when required. Individual power meter, noise generator, and crystal frequency access also permit seperate component operation.

(e) Demonstration of C/I test capability

In the C/I ratio mode, the HP 3708A permits interference simulation. The wideband input permits C/I testing with most interference types, including lightning, radar and other radio interference. This is an important feature in development labs, particularly for testing satellite systems.

1.4 Demonstrating the HP 3708A to manufacturing

In isolation or with software, the HP 3708A makes significant contributions in manufacturing. Promote the key features listed below:

☐ Accurate and practical way to make C/N ratio vs BER tests - access at radio IF.

☐ Measurement repeatability. Specified C/N ratio accuracy.

☐ Wide range of software features including autosequencing - allow unattended measurements.

☐ Quick and easy comparison of system performance relative to performance masks. Modem-to-modem comparison to show up manufacturing tolerances and set-up conditions.

Manufacturing require accurate and repeatable measurements and quick and efficient test throughput. This is the HP 3708A's primary market. Coupled with the software, this measurement system significantly improves testing accuracy, repeatability and throughput. The HP 3708A connects to the radio IF section, and is rack mountable for inclusion in a complete manufacturing test system.

Demonstrate the key areas shown in the figure:
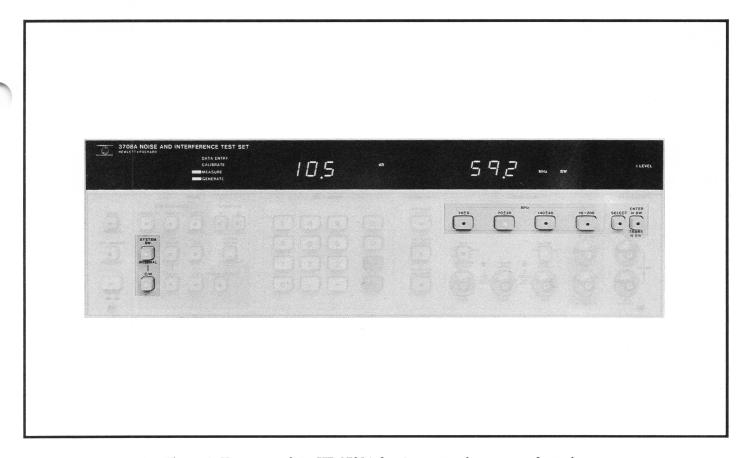
Figure 3 Key areas of the HP 3708A for demonstration to manufacturing

Place emphasis on measurement accuracy and repeatability, and fast testing throughput with the instrument alone, or combined with software.

(a) C/N ratio measurements

C/N ratio vs BER measurements form the main out-of-service tests for radio manufacturers. (Satellite and other narrow bandwidth system manufacturers perform C/No and Eb/No ratio vs BER tests.) Implementation margin and background (residual) BER measurements from these tests are most common, and the HP 3708A is the best method of making these measurements. IF-IF loopback and RF-RF loopback form the main radio tests. They stress the radio modem components and RF components in the radio system. Four internal filters suit the needs of most manufacturers, and the instrument allows connection of other filters by using the external filter input.

(b) Bit error rate (BER) soak testing

Normally performed by measuring the BER of links at regular intervals over an extended period (typically 100 hours). The C/I technique reduces this measurement time. Use it to increase measurement confidence, in conjunction with the long gating period method, or as a direct substitute, thereby saving testing time. Product Note 3708-3, 'Determination of Residual Bit Error Ratio in Digital Microwave Systems' Publication Number 5954-5490 describes this technique.

(c) Using the software to compare measured performance to standards

The software allows users to enter their own curve data from the keyboard. Use this to enter pre-defined standard performance tolerance masks for direct performance comparison with measured performance. The demonstration pack in Section 1.9 gives full software demonstration.

The HP 3708A causes no group delay or insertion loss, and can be left in circuit when testing is not performed.

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1.5 Demonstrating the HP 3708A to operators and utilities

Installation, commissioning and maintenance teams require different features from the other two categories. They operate in different environments, and require C/N accuracy, portability and cost-effective ownership. Promote the key features listed below:

- The HP 3708A provides accurate C/N ratio vs BER measurements with carrier level variation. The noise tracking facility provides this.

- Instrument portability. Easy instrument transportation to different sites permits remote radio system testing.

- Low cost of ownership. Increased testing speed, result reliability and easy IF access combine to make the HP 3708A more cost-effective than traditional RF attenuators.

- Interference simulation. The C/I mode permits simulation of interference such as radar, adjacent channel and electrical noise to characterize performance.

- Measurement automation. This provides radio characterization and results comparison to a performance mask, and other radio system comparison.

Demonstrate the key areas shown in the figure:
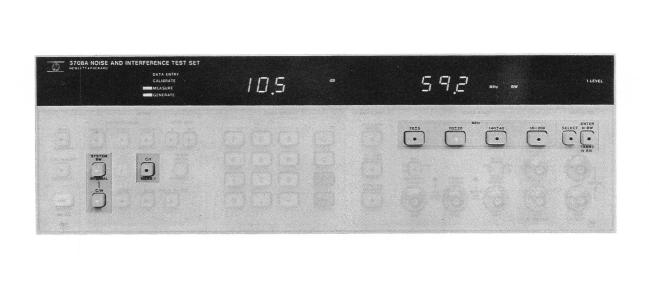
Figure 4 Key areas of the HP 3708A for demonstration to operators and utilities

Place emphasis on measurement repeatibility in varying carrier conditions, quickness and ease to make measurements, and portability.

1.6 I want to demonstrate the HP 3708A using a digital radio or other system

If you have access to a digital radio system, you need the following equipment:

Quantity	Description
1	HP 3708A Noise and Interference Test Set
1	Pattern generator
1	Error detector
1	Digital radio, satellite or other RF modem
x	Miscellaneous cables and adaptors

Equipment connection - schematic and actual are shown in Figures 5 and 6 respectively:

Figure 5 Schematic diagram

Figure 6 Connection diagram

HP-IB

CONTROLLER
AND DISC DRIVE

DS3 O/P

IF IN   IF OUT

DS3 I/P

3781A
3781B
P/O 3764A
OR P/O 3789A/B

3782A
3782B
P/O 3764A
OR P/O 3789A/B

1.7 I want to demonstrate the HP 3708A but I don't have a radio system

If radio access is not available, the HP 3717A 70MHz Modulator-Demodulator and HP 3789A/B provide radio simulators. These are useful as demonstration tools for trade shows and other events. You need the following equipment:

Quantity	Description
1	HP 3708A Noise and Interference Test Set
1	Pattern generator
1	Error detector
1	HP 3717A 70 MHz Modulator/Demodulator (with 5 dB attenuation)
x	Miscellaneous cables and adaptors

Note: The 3717A maximum data-rate is approximately 2Mbit/s, so use either a DS1 (US) or a 2Mbit/s (Europe) signal with the pattern generator and error detector. The HP 3789A/B doesn't provide a DS1 signal. It is restricted to DS3.

Equipment connection - schematic and actual are shown in Figures 7 and 8 respectively:
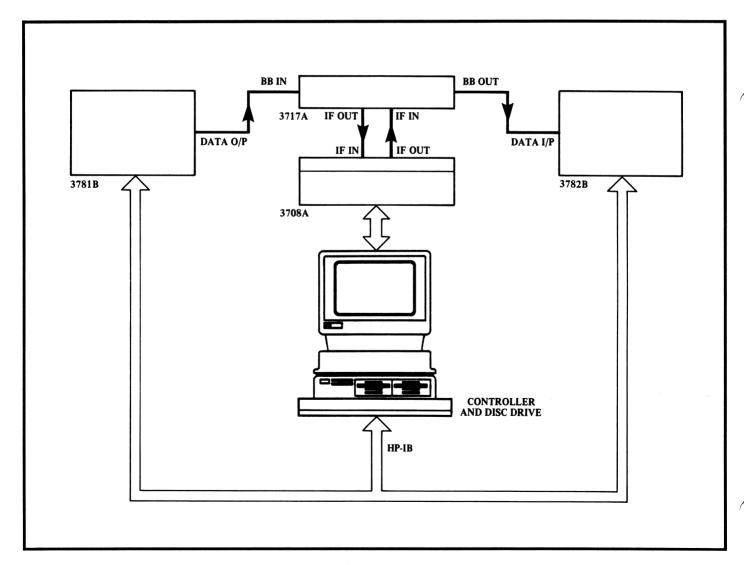
Figure 7 Schematic diagram

3717A

DATA O/P

3781A – 2Mbit/s
3781B – DS 1
OR P/O 3764A – 2Mbit/s
(4 FREQ OPTION)

3708A

IF IN

IF OUT

DATA I/P

3782A – 2Mbit/s
3782B – DS 1
OR P/O 3764A – 2Mbit/s
(4 FREQ OPTION)

**CONTROLLER
AND DISC DRIVE**

HP-IB
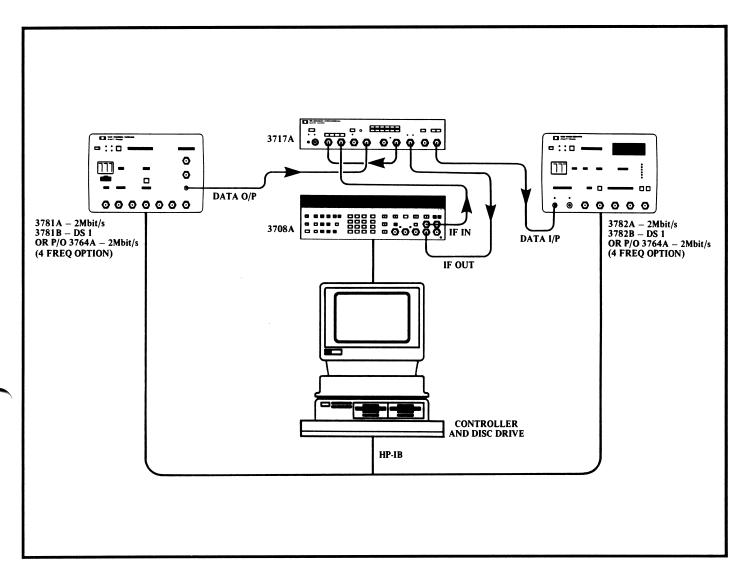
Figure 8 Connection diagram

The DS3 signal from the HP 3789A/B provides a suitable signal for direct HP 3708A demonstration. You need the following equipment:

Quantity	Description
1	HP 3708A Noise and Interference Test Set
1	HP 3789A/B DS3 Transmission Test Set
x	Miscellaneous cables and adaptors

Equipment connection - schematic and actual are shown in Figures 9 and 10 respectively:
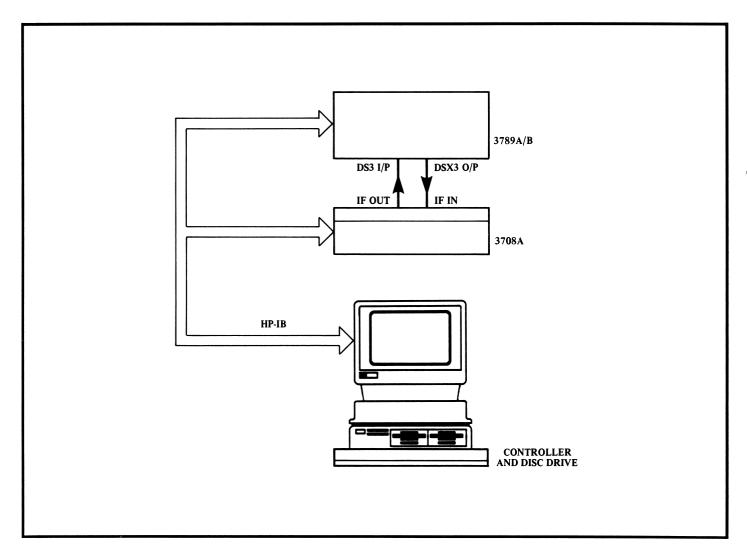
Figure 9 Schematic diagram

3789A/B

DS3 I/P   DSX3 O/P

3708A

IF IN
IF OUT

HP-IB

CONTROLLER
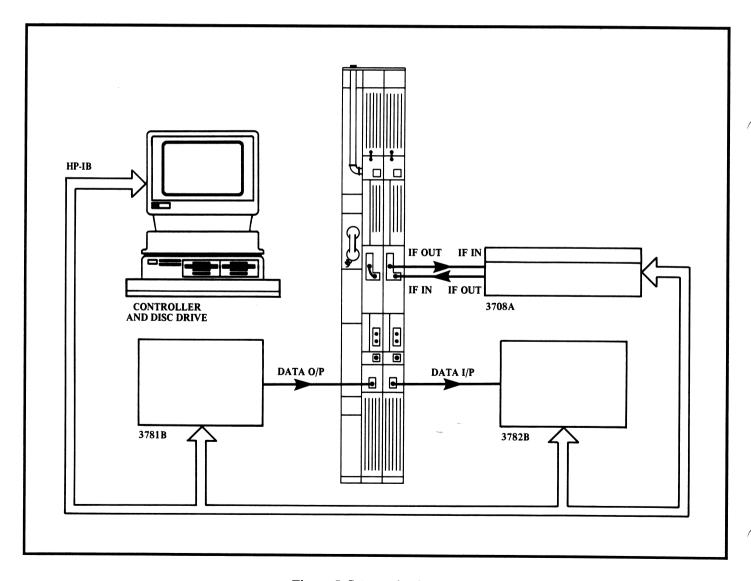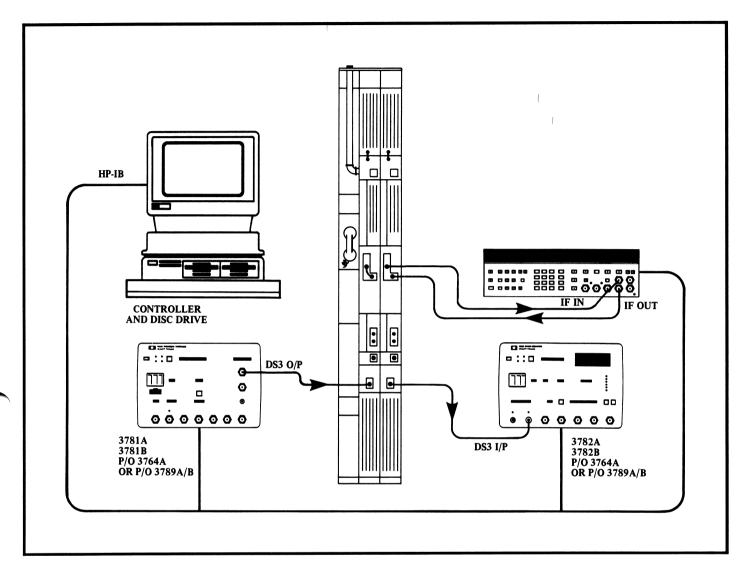AND DISC DRIVE
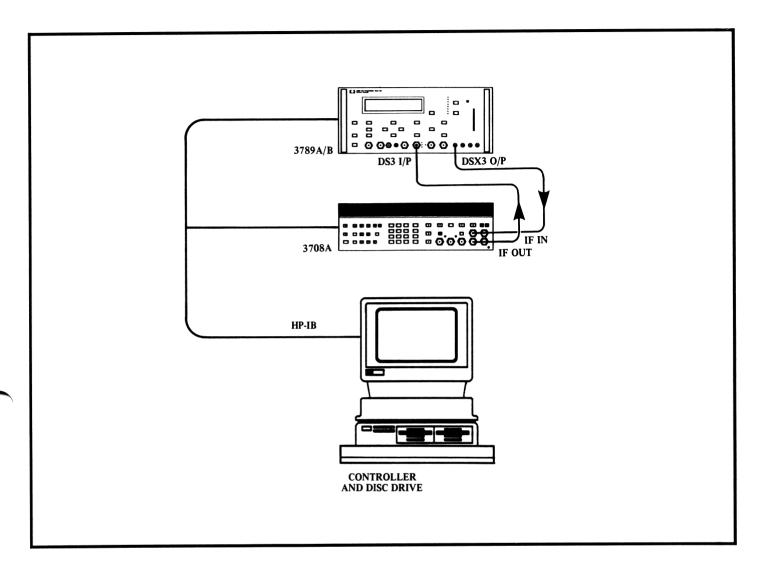
Figure 10 Connection diagram

1.8 I want to automate the measurements

The HP 3708A Demonstration Software provides the most impressive HP 3708A demonstration. This automates HP 3708A and BER test set operation for measurements, and file manipulation. Part 2 of this guide gives a full description of software features, but this section shows equipment connection, and allows you to get up and running fast. Section 1.9 contains a demonstration pack which shows easy software operation. Automating measurements with the HP 3708A requires the following equipment:

Quantity	Description
1	HP 3708A Noise and Interference Test Set (HP-IB address 8)
1	HP 3781A AND HP 3782A (HP-IB address 9/10 resp)
or 1	HP 3782B AND HP 3782B (HP-IB address 9/10 resp)
or 1	HP 3764A(4 freq option) (HP-IB address 3)
or 1	HP 3789A/B (HP-IB address 6)
1 set	HP 3708A demonstration software
1	Series 200 or Series 300 controller (See #)
1*	HP 9122D dual double-sided disc drive
1	HP-IB printer - eg. HP 2225A Thinkjet
1	HPGL plotter - eg. HP 7550A
x	Miscellaneous cables and adaptors

* A single 3.5 inch double-sided disc drive (for example that contained on the HP 9153B) may be used as a substitute, but you can't specify autosequences easily with the single disc drive.

\# (1) **HP 98580A (Bundled system)** : Model 310 computer, medium resolution monochrome display, 1024 kbytes RAM, built-in HP-IB interface, BASIC Language System.

Option 008 : HP 98546A display compatibility interface required.

Note: The BASIC Language System is not required when running the software. This system uses only 1 HP-IB port. This is satisfactory for most applications. You can fit a second port for instrumentation control if required. The extra HP-IB port model number is HP 98624A.

(2) **HP 9816S** : Model 9000 Series 200 controller, 512 kbytes RAM, built-in HP-IB interface.

Note: We do not recommend running the software on the current PC 308 Vectra with VIPER card.

1.9 Software demonstration pack

Pre-stored autosequences make the HP 3708A demonstration software easy to use. Each disc contains the following autosequences:

DEMO 1 - The HP 3708A with a selection of different radio systems
DEMO 2 - The HP 3708A with the radio simulator when a radio is not available
DEMO 3 - The software without using any instruments.

Each demonstration highlights different software features, so you can perform demonstrations easily with and without using the HP 3708A.

Also contained is a performance mask showing a pre-stored curve; this is for measurement curve comparison.

There are five discs, controlling different pattern generator/error detectors and providing the PASCAL operating system for autosequence specifications. The autosequences use the following IF frequencies and data rates:

Disc	Function
1	Controls HP 3781A & 3782A; uses 70 MHz IF, 34 Mbit/s data rate
2	Controls HP 3781B & 3782B; uses 70 MHz IF, DS3-Hi data rate
3	Controls HP 3764A; uses 70 MHz IF, 139 Mbit/s data rate
4	Controls HP 3789A/B; uses 70 MHz IF, DS3-Hi data rate
5	PASCAL 3.01 disc; for specifying autosequence text files

By pressing only a few keystrokes, these demonstrations show some key software features. The following text describes the autosequences:

Demo 1

For this demonstration, connect the HP 3708A and pattern generator/error detector to the radio system. Also, you need the HP 3708A, the correct pattern generator and error detector, plotter and disc drive connected to the computer system.

Running Demo 1

Switch on the computer with the correct disc inserted. Step through the following procedure once the system has loaded:

- Enter a new date in the specified format. Press <RETURN/ENTER> to confirm.
- Enter a new time in the specified format. Press <RETURN/ENTER> to confirm.

- The following menu appears at the top of the screen:

━━━━━━━━━━━━━━━━━ Time - Prefix - Volumes - Nims ━━━━━━━━━━━━━━━━━

- Press 'N' to load NIMS system

The system takes a short time to load.

- Press '5' to load Perform a command SEQUENCE
- Press '2' to change the sequence name
- Type 'DEMO1' to load the autosequence from the sequence directory. Confirm by pressing <RETURN/ENTER>
- Press '1' to start the sequence

From here, view the SEQUENCER text at the bottom of the screen for information. This tells you which stage you're at. Built-in pauses provide delays for software explanation. Proceed by pressing <RETURN/ENTER> when you are ready.

The sequence performs the following tasks:

- Retrieves a pre-stored measurement set-up from disc
- Executes real measurements using a digital radio, the HP 3708A, and an HP Bit Error Rate Test Set
- Displays the resulting curve
- Load a second pre-stored curve
- Displays this curve then superimposes this and the measured curve on the same axis
- Changes the scaling, units, and manipulates the data
- Plots the two curves on a plotter

Section 2.6 shows the autosequence printout.

Demo 2

If a radio system or other modem system is not available, then use an HP 3717A 70MHz Modulator-Demodulator (or HP 3789A/B directly). This shows you how to demonstrate the HP 3708A under software control using the HP 3717A and a suitable BER Test Set.

For this demonstration, connect the HP 3708A and pattern generator/error detector to the HP 3717A radio simulator. (In the HP 3789A/B case, connect the DSX-3 output directly to the HP 3708A IF input, and IF output to the HP 3789A/B DS3 input). Also, you need the HP 3708A, the correct pattern generator and error detector, plotter and disc drive connected to the computer system.

Running Demo 2

Switch on the computer with the correct disc inserted. Step through the following procedure once the system has loaded:

- Enter a new date in the specified format. Press <RETURN/ENTER> to confirm.
- Enter a new time in the specified format. Press <RETURN/ENTER> to confirm.

- The following menu appears at the top of the screen:

━━━━━━━━━━━━━━━━━━━ Time - Prefix - Volumes - Nims ■━━━━━━━━━━━━

- Press 'N' to load NIMS system

The system takes a short time to load.

- Press '5' to load Perform a command SEQUENCE
- Press '2' to change the sequence name
- Type 'DEMO2' to load the autosequence from the sequence directory. Confirm by pressing <RETURN/ENTER>
- Press '1' to start the sequence

From here, view the SEQUENCER text at the bottom of the screen for information. This tells you which stage you're at. Built-in pauses provide delays for software explanation. Proceed by pressing <RETURN/ENTER> when you are ready.

The sequence performs the following tasks:

- Retrieves a pre-stored measurement set-up from disc
- Executes measurements using a simulated radio, HP 3708A, and an HP Bit Error Rate Test Set
- Displays the resulting curve
- Loads a second pre-stored curve
- Displays this curve then superimposes this and the measured curve on the same axis
- Changes the scaling, units, and manipulates the data
- Plots the two curves on a plotter

Section 2.6 shows the autosequence printout.

Demo 3

This demonstration requires no instruments to show system capability. It uses pre-stored curves taken from radio measurements and compares them to pre-defined theoretical curves. Trade shows, exhibitions, and direct customer demonstrations form the main reasons for this demonstration, where equipment may be difficult to obtain. A computer and disc drive is the only required equipment.

Running Demo 3

Switch on the computer with the correct disc inserted. The demonstration is the same for all discs. Step through the following procedure once the system has loaded:

- Enter a new date in the specified format. Press <RETURN/ENTER> to confirm.
- Enter a new time in the specified format. Press <RETURN/ENTER> to confirm.

- The following menu appears at the top of the screen:

━━━━━━━━━━━━━━━━━━━━━━━━━ **Time - Prefix - Volumes - Nims** ━━━━━━━━━━━━━━━━━━━━━━━━━

- Press 'N' to load NIMS system

The system takes a short time to load.

- Press '5' to load Perform a command SEQUENCE
- Press '2' to change the sequence name
- Type 'DEMO3' to load the autosequence from the sequence directory. Confirm by pressing <RETURN/ENTER>
- Press '1' to start the sequence

From here, view the SEQUENCER text at the bottom of the screen for information. This tells you which stage you're at. Built-in pauses provide delays for software explanation. Proceed by pressing <RETURN/ENTER> when you are ready.

The sequence performs the following tasks:

- Loads a pre-stored curve from disc
- Displays this curve
- Loads a second curve
- Displays this second curve
- Superimposes both curves on the same axes
- Changes the scaling, units and manipulates the data
- Mentions use for determining implementation margin
- Mentions plotting capability

Section 2.6 shows the autosequence printout.

Mask

This is not an autosequence, but a pre-defined specification performance 'mask' which may indicate measurement performance limits. This brief demonstration illustrates the software's ability to compare measured data with the performance mask. Stored on each disc are two curves; a typical performance curve and a MASK curve. The demonstration is the same for all discs. Perform the following steps to show how easy it is to use:

Demonstrating the performance Mask

Switch on the computer with one correct disc inserted. The demonstration is the same for all discs. Step through the following procedure once the system has loaded:

- Enter a new date in the specified format. Press <RETURN/ENTER> to confirm.
- Enter a new time in the specified format. Press <RETURN/ENTER> to confirm.

- The following menu appears at the top of the screen:

══════════════════════════════ Time - Prefix - Volumes - Nims ══════════════════════════════

- Press 'N' to load NIMS system

The system takes a short time to load.

- Press '1' to load BER vs C/N type measurements
- Press '3' to enter the CURVE manager
- Press '4' to enter the 'file' function
- Press 'L' to LOAD a file
- Type in 'DEMO3' then press <RETURN/ENTER>
- Press 'L' to LOAD a file
- Type in 'MASK16' then press <RETURN/ENTER>
- Press 'R' to return
- Press 'R' to go to level above
- Press '4' to enter RESULTS presentation
- Press '1' to enter 'screen' mode

The screen displays the pre-defined MASK. To superimpose the measured curve, perform the following:

- Press '1' to select 'curves'
- Press '1' to select to display the second curve (an asterisk beside DEMO3)
- Press 'R'

The screen now displays both curves. Performance mask and measured performance comparison is now easy. This illustrates the software's versatility, ease of use, and wide application in improving measurements.

Part 2

Contents

2.1 Software tour

This part illustrates HP 3708A demonstration software features and software operation. It also describes autosequence definition and use of the autosequence function.

With the equipment connected, switch on the instruments, disc drive and peripherals, but leave the controller switched off. Insert the disc into the disc drive; Drive 0, then switch on the controller. The system loads into the controller and after about 20 seconds, a new date prompt appears. Enter a new date then press <RETURN/ENTER>. A similar prompt appears for setting up a new time. Enter this, followed by <RETURN/ENTER>, then a command level appears at the top of the screen.

The demonstration pack in Section 1.9 showed you how to get the software working. The computer displays this main menu level after switch on:

━━━━━━━━━━━━━━━━━━━━━━━━━━ Time - Prefix - Volumes - Nims ━━━━━━━━━━━━━━━━━━━━━

We are now ready to do a software tour. Follow these steps to familiarize yourself with software operation.

We are at the main command level. There are four options. Pressing 'T' allows changing time and date. Pressing 'P' allows changing the volume prefix to any six character input followed by a ':'. Terminate the input by pressing <RETURN/ENTER>. Pressing 'V' lists the current volumes on line. This is useful if you want to view the volume labels contained on the discs.

Pressing 'N' loads the Noise and Interference Measurement System into the computer. After a short time, the system displays the main menu level.

At this level there are 5 options plus HELP and EXIT system.

1   BER vs C/N type measurements, performs automated Carrier-to-Noise measurements using the HP 3708A.

2   BER vs C/I type measurements, performs automated Carrier-to-Interference measurements using the HP 3708A.

3   Re-CONFIGURE the system, specifies the system configuration, HP-IB addresses, instrument options, and default set-up conditions for C/N and C/I testing. You can store new configurations on the disc.

4   SELF-TEST of instruments, provides a written text message which refers you to the system REFERENCE MANUALS for the particular instruments used by the software if there is a problem.

5   Perform a command SEQUENCE. This starts a pre-specified sequence of commands known as an autosequence. These are specified elsewhere*. It also lists the current sequences held on disc and changes a sequence name.

     *The sequence specifies the commands as a text file - explained in Section 2.6

H   HELP information gives you textual information about C/N and C/I ratio measurements, Configuration, and operation sequencing. After reading the desired information, pressing 'R' will send you back to the main menu.

E   EXIT system returns to the main command level.

2.2 BER vs C/N and C/I type measurements

Features relating to BER vs C/N and BER vs C/I measurements in the software are identical. There are only minor differences in the measurement PARAMETER set-up conditions and in the RESULTS Presentation of the data. The following description combines the features of both measurement types.
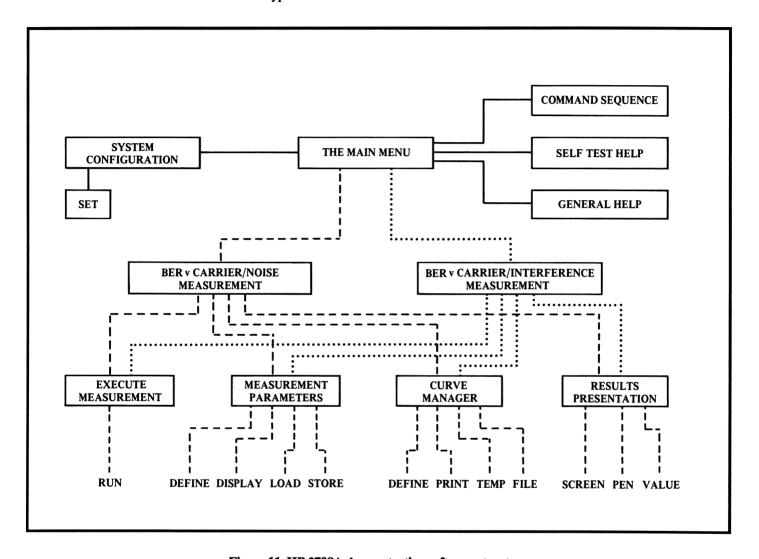
Figure 11 HP 3708A demonstration software structure

Note: At each stage of software operation, options are clearly stated, and touching 'H' displays Help information at the current level.

For both C/N and C/I measurements, there is an easy-to-follow command hierarchy. Inverse video markers show the current position, and all functions are accessable by using keys '1','2','3','4','R' and 'H'. At each level, the top left 'window' shows available options. The following section views each available option.

2.2.1 EXECUTE measurement

This option puts the software in the measurement execution mode. Measurement conditions require setting up before measurement execution. The Measurement PARAMETERS section shows you how to specify measurement set-up conditions.

The software contains pre-loaded measurement set-up conditions 'DEMO3'. From here, a <SPACE> bar executes the measurement. The screen displays set-up parameters, then the measurement graph axes.

Pressing the <SPACE> bar changes the display from the measurement axes to measurement parameters. At any time, pressing 'A' aborts the measurement.

At the end of the measurement, the system asks for a curve title and file name. These curves form the datafiles which the system uses for storage and manipulation. Figure 12 shows this page.

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                           │
│            ┌─────────────────────────────────────────────┐               │
│            │            MEASUREMENT execution             │               │
│      ┌─────┴──────────────────────────────────────┐ ┌─────┴─────────┐     │
│      │ FEATURES    :  noise tracking .........  YES│ │               │     │
│      │                added interferer .......  NO  │               │     │
│      │                residual compensation ..  NO └───────────────┘     │
│      │                                                              │     │
│      │ MEASUREMENT RANGE :  <     5.0>   to  <    35.0>    step  <     1.0>│
│      │ BER RANGE           :  < 1.0E-001>  to  < 1.0E-015>   averaged over  <   1>│
│      │                                                              │     │
│      │ GATING PERIOD       :   <         100 errors   >             │     │
│      │                                                              │     │
│      │ MEASUREMENT UNITS :   <  C/N   >       system bandwidth (MHz)     22.00│
│      │ NOISE FILTER        :   <70 +/-20>                            │     │
│      │                         format      -  2 Mb/s 75 ohm    TERM  │     │
│      │                         pattern     -  2^15-1          zero sub :  0│
│      │                         code        -  AMI                    │     │
│      │                         error type  -  BIN                    │     │
│      └──────────────────────────────────────────────────────────────┘     │
│        ---- <SPACE> toggles graph/setup ----- <A>, <STOP> abort the measurement -----│
│                                                                           │
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 12 'EXECUTE Measurement' option page

2.2.2 Measurement PARAMETERS

This option defines measurement conditions for performing measurements. It provides features for defining, displaying, loading and storing measurement set-up conditions. Looking at them in turn:

define

This command defines measurement conditions for automated measurements. Parameters divide into 5 categories.

In addition, help information 'H' explains parameter types. Choose a number from a multiple choice listing. If parameters don't need re-specifying then pressing 'L' leaves the rest and returns to the main parameter DEFINITION level. Figure 13 shows this page.

```
┌──────────────────────────────────────────────────────────────────────┐
│             ┌────────────────────────────────────────┐               │
│             │         DEFINITION of new parameters    │               │
│             └────────────────────────────────────────┘               │
│                                                                        │
│                    current setup name    ...   DEMO3                   │
│  ──────────────────────────────────────────────────────────────────  │
│                                                                        │
│      NB : When a previous set of parameters are being altered, any values can be left │
│           unchanged by typing only <ENTER> to any menu selection OR date entry.       │
│         Typing <L> as any menu choice will LEAVE that parameter and RETURN to here.   │
│                                                                        │
│                    1 .. 3708A parameters                               │
│                    2 .. RANGES of measurement                          │
│                    3 .. BER test set parameters                        │
│                    4 .. SPECIAL FEATURES of measurement                │
│                    5 .. COMMENT and NAME of setup                      │
│                                                                        │
│                    R .. RETURN back to previous menu                   │
│                    H .. HELP information                               │
│                                                                        │
│                          selection ..                                  │
│                                                                        │
└──────────────────────────────────────────────────────────────────────┘
```
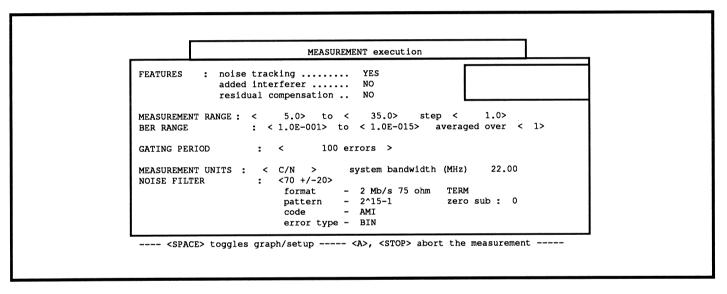
Figure 13 'define' option page

Each of the four discs contains different parameters for different BER Test Sets. They are self explanatory, and menu driven from a multiple-choice selection.

display

This mode displays the current instrument parameter set-up held in computer memory. Figure 14 shows this page.

```
┌──────────────────────────────────────────────────────────────────────────┐
│        ┌────────────────────────────────────────────────┐                │
│        │        DISPLAY the current set of parameters    │                │
│  ┌─────┴────────────────────────────────────────┐  ┌─────┴──────────────┐ │
│  │ FEATURES    : noise tracking ........  YES    │  │ SETUP : DEMO3      │ │
│  │               added interferer ......  NO     │  │ DATE  : 16-Feb-79  │ │
│  │               residual compensation .. NO     │  └────────────────────┘ │
│  │                                                                         │
│  │ MEASUREMENT RANGE :  <     5.0>   to  <    35.0>    step  <    1.0>      │
│  │ BER RANGE          : < 1.0E-001> to  < 1.0E-015>  averaged over <  1>    │
│  │                                                                         │
│  │ GATING PERIOD      :  <       100 errors  >                             │
│  │                                                                         │
│  │ MEASUREMENT UNITS :  <  C/N   >       system bandwidth (MHz)    22.00    │
│  │ NOISE FILTER       :   <70 +/-20>                                       │
│  │                        format    - 2 Mb/s 75 ohm    TERM                │
│  │                        pattern   - 2^15-1           zero sub :  0        │
│  │                        code      - AMI                                  │
│  │                        error type - BIN                                 │
│  │ COMMENT        : DEMO3 - Demonstration Autosequence configuration       │
│  └─────────────────────────────────────────────────────────────────────┘ │
│                         - <SPACE> proceeds                                 │
└──────────────────────────────────────────────────────────────────────────┘
```

Figure 14 'display' option page

load

You can recall specified parameters previously stored on disc into computer memory. Loading set-up parameters overwrites the memory contents. Figure 15 shows this page.

```
                  ┌──────────────────────────────────────────┐
                  │      LOAD a set of parameters from file   │
                  │                                           │
                  └──────────────────────────────────────────┘

                     current setup name   ...   DEMO3
   ─────────────────────────────────────────────────────────────────

            FILE DIRECTORY
            (existing files)
                  ┌─────────┐
                  │ DEMO3   │      <SPACE>  .. more DIRECTORY
                  │ DEMO1   │      <ENTER>  .. LOAD the setup
                  │ DEMO2   │         R  ..... RETURN to previous menu
                  │         │
                  │         │      your selection ..
                  │         │
                  │         │      setup file-NAME  :
                  │         │
                  └─────────┘
```
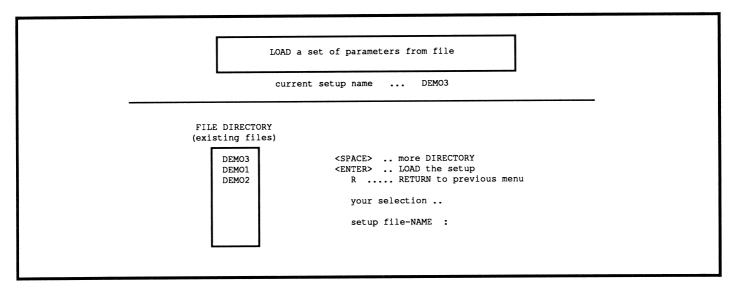
Figure 15 'load' option page

store

Newly specified parameter storage is possible with this feature. It is normal to follow measurement parameter creation by file storage for protection. File names up to six alphanumeric characters identify the measurement set-up conditions. If you omit to specify a filename, the system assigns a default system filename. Specifying a file with the same filename as one already stored overwrites the previous file. Figure 16 shows this page.

```
                  ┌──────────────────────────────────────────┐
                  │              STORE a setup                │
                  │                                           │
                  └──────────────────────────────────────────┘

                     current setup name   ...   DEMO3
   ─────────────────────────────────────────────────────────────────

                           Note :   Typing only <ENTER> for the file name
                                        will use the default name shown.
            FILE DIRECTORY
            (existing files)
                  ┌─────────┐
                  │ DEMO3   │      <SPACE>  .. more DIRECTORY
                  │ DEMO1   │      <ENTER>  .. STORE the setup
                  │ DEMO2   │         R  ..... RETURN to previous menu
                  │         │
                  │         │      your selection ..
                  │         │
                  │         │      setup file-NAME  :
                  │         │
                  └─────────┘
```

Figure 16 'store' option page

2.2.3 CURVE manager

This option manages curve data made from making measurements or manually defined curves. It provides features for defining and printing curve data, manipulating curve data from internal memory, and storage, retrieval and deleting curves from disc. Looking at each in turn:

define

User-entered curves allow performance masks, theoretical and other curve definition. The upper display shows the carrier-to-noise and BER ranges specified in the measurement setup conditions. This represents the 'window' for specifying C/N and BER parameters. Figure 17 shows this page.
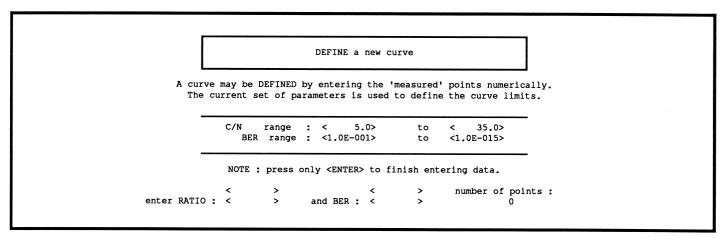
```
                    ┌─────────────────────────────────────────────────┐
                    │                 DEFINE a new curve              │
                    └─────────────────────────────────────────────────┘

            A curve may be DEFINED by entering the 'measured' points numerically.
            The current set of parameters is used to define the curve limits.

              ┌──────────────────────────────────────────────────────┐
              │  C/N    range  :  <     5.0>     to    <    35.0>      │
              │       BER  range  :  <1.0E-001>     to    <1.0E-015>   │
              └──────────────────────────────────────────────────────┘

                  NOTE : press only <ENTER> to finish entering data.

                     <        >              <        >    number of points :
         enter RATIO : <        >    and BER : <        >              0
```

Figure 17 'define' option page

Entering the unit value (eg. C/N ratio of 25 dB) and corresponding BER value allows curve construction point by point. Displaying the previous point guards against losing your place when defining curves.

print

Printing curve data in a tabular form permits closer curve point identification. This facility prints curve data and measurement set-up conditions. Select the desired curve from a list of curves currently held in memory. Figure 18 shows this page.
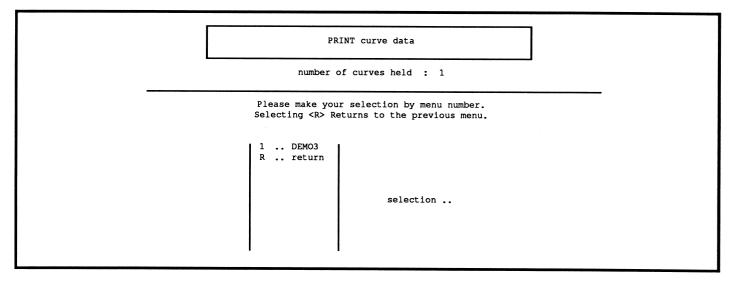
```
                    ┌─────────────────────────────────────────────────┐
                    │                 PRINT curve data                │
                    └─────────────────────────────────────────────────┘

                         number of curves held  :  1

          ─────────────────────────────────────────────────────────────

                    Please make your selection by menu number.
                    Selecting <R> Returns to the previous menu.

                 │ 1  .. DEMO3 │
                 │ R  .. return│
                 │             │
                 │             │
                 │             │     selection ..
                 │             │
                 │             │
                 │             │
                 │             │
```

Figure 18 'print' option page

temp

This option provides curve manipulation of measured or defined curves. Curve deletion removes unwanted curves, and curve marking prevents curve deletion when on-board memory overflows. This last feature is important for retaining curves such as masks, theoretical performance or reference curves. Figure 19 shows this page.

```
            +-------------------------------------------------+
            |       KEEP and DELETE curves in the temporary list |
            +-------------------------------------------------+

                        number of curves held  :  1
    _____

            NOTES : To  PREVENT a curve from automatically being removed from the
                        list, select <P> followed by the curve NUMBER.
                    To DELETE a curve yourself, use <D> followed by the curve NUMBER.

            CURVE CHOICE
            1 .. DEMO3
            R .. return      P  .. make a curve PERMANENT in list
                             D  .. DELETE a curve from the list

                             R  .. RETURN to previous menu

                             option selection ..
                             curve choice ...
                                               +----------------------+
                                               | Memory : 126 Points  |
                                               +----------------------+
```

Figure 19 'temp' option page

file

This option provides curve manipulation of curve data stored on computer disc. Curve deletion erases unwanted curves, and curve loading and storage options stores and retrieves curve data. Figure 20 shows this page.

```
            +-------------------------------------------------+
            |          LOAD and STORE curves on file          |
            +-------------------------------------------------+

                        number of curves held  :  1
    _____

            NOTES : To STORE a curve, select <S> followed by the CURVE NUMBER;
                    To LOAD or DELETE a curve, select <L> followed by the FILE NAME.

            CURVE CHOICE                              FILE DIRECTORY
            (temp store)      <shift/space>,          (existing files)
            1 .. DEMO3            <space> .. catalog file dir
            R .. return          L ..... LOAD a file <------      +---------+
                            ------>  S ..... STORE a curve        | DEMO3   |
                                     D ..... DELETE a file        | QPSK    |
                                                                  | 16QAM   |
                                     R ..... RETURN               | DEMO1X  |
                                                                  | MASK16  |
                             option selection ..                 |         |
                             curve choice ...                     +---------+
```

Figure 20 'file' option page

2.2.4 RESULTS presentation

This option displays and manipulates curve data on the screen or to a plotter. It also homes in on specific curve sections for more detailed measurement data. Looking at each in turn:

screen

This option displays curve data on the screen for viewing and manipulation. This command has many facilities. From the main SELECTION field, pressing keys 1 to 5 selects different options. Figure 21 shows this option.
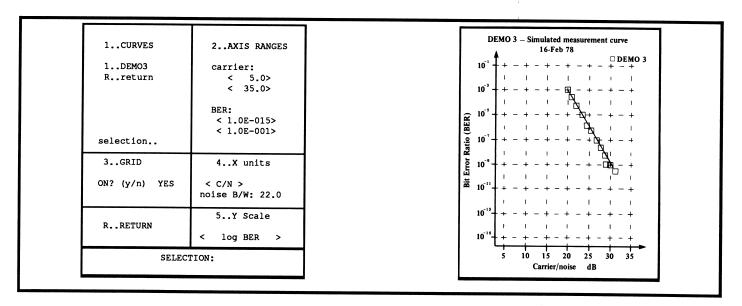

Figure 21 'screen' option page

Curves - The system selects or deselects curves from this option. Select or deselect curves by pressing the curve number. An '*' denotes selection. This option allows multiple curve selection on the same axes. Press 'R' to return to the SELECTION: level.

Note: The system automatically displays the last curve loaded into memory.

Axis ranges - The user can highlight particular curve sections by altering the X axis or Y axis scaling. To confirm new value selection, press <RETURN/ENTER>. To retain original values press <RETURN/ENTER> without changing any figures.

Grid - This is a 'toggle' type control. Pressing 'Y' turns the grid on, and 'N' turns the grid off. This option is valuable, particularly for multiple curve plots, where the screen may be 'cluttered'.

X units - Using this option, the system provides conversion between C/N, C/No, Eb/No and RF power. Different options require entering additional information. C/N requires the noise bandwidth in MHz, Eb/No requires bit rate in Mbit/s, and RF power requires the Noise figure. Press <RETURN/ENTER> for entry confirmation. The system recalculates the X axis units, and redisplays the curves. Product Note 3708-2, Publication Number 5953-5489, p.16 shows the relationship between these units.

Y scale - This is a 'toggle' type control. The system changes the option between log BER and Log (log BER) by using the space-bar. Pressing <RETURN/ENTER> confirms selection. Manufacturers prefer the Log (log BER) scale in preference to the usual log BER because it provides clearer result interpretation.

pen

This option controls curve plotting for curves selected and manipulated from the screen mode. It has features which set plot orientation, size of graph and label selection. Figure 22 shows this option.

```
                    ┌──────────────────────────────────────────┐
                    │        PLOT graph on PEN plotter          │
                    └──────────────────────────────────────────┘

        NB.    The graph axes and labelling are done with PEN 1, the curves with PEN 2.

               Before each curve is drawn, an opportunity is given to change PEN 2
               so that the curves can be drawn in different colours.

                              ┌──────── PLOT CONFIGURATION ────────┐
                              │                                    │
                              │  * Plot Orientation ..... < Vertical > │
                              │  * Draw graph with labels ..... < YES> │
                              │  * Size of graph ........ <Maximum  >  │
                              └────────────────────────────────────┘

                   <space> .. draw the graph
                   <enter> .. change configuration           Selection ..
                         R ..... Return to the previous menu
```

Figure 22 'pen' option page

Plot orientation - The system performs plotting in either horizontal or vertical aspect ratio to suit different requirements.

Draw graph with labels - Some manufacturers have pre-printed axes so they don't require axes labels. This option allows axis label masking if required.

Size of graph - The system has three graph size options. 'Maximum' sets the plot to the maximum size for the plotter. 'User Def' sets the plot to a user-defined plot size. This requires setting the plot origin and marking the outer limit of the required plot. Move the pen with the up, down, and sideways arrows, and press the plotter <ENTER> key to confirm position.

Note: This marks the graph axes. The system requires additional X and Y axis border space. Axes marking too close to the paper edge results in a message 'Area defined will not fit on plotting device'. If this occurs, press <RETURN/ENTER> then <SPACE> bar to redefine this area.

The 'Preset' option uses the last user-defined plot size as the plotting area. Manufacturers require this feature for repeated measurements.

value

This option provides curve point analysis in more detail than plot observation. This is useful in identifying certain areas on the measurement curve which have borderline specifications. Identify the particular curve required for analysis, enter the BER value (for example 1E-6), then the system calculates the equivalent C/N ratio. Manufacturers find this valuable to measure C/N performance at a specified level of BER. Figure 23 shows this option.
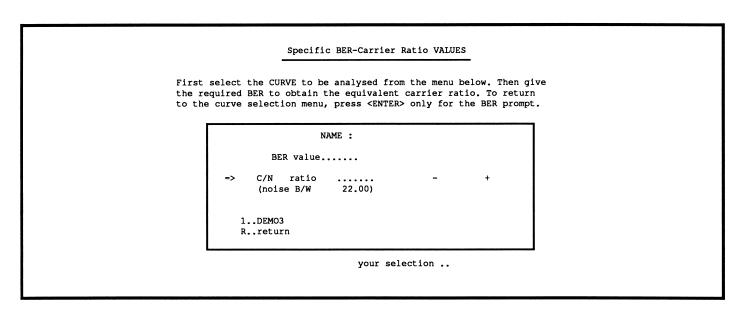
```
                        Specific BER-Carrier Ratio VALUES
                        ──────────────────────────────────

            First select the CURVE to be analysed from the menu below. Then give
            the required BER to obtain the equivalent carrier ratio. To return
            to the curve selection menu, press <ENTER> only for the BER prompt.

                    ┌─────────────────────────────────────────┐
                    │                NAME :                   │
                    │                                         │
                    │        BER value.......                 │
                    │                                         │
                    │  =>    C/N   ratio    .......      -      +  │
                    │        (noise B/W     22.00)            │
                    │                                         │
                    │                                         │
                    │     1..DEMO3                            │
                    │     R..return                          │
                    └─────────────────────────────────────────┘

                              your selection ..
```

Figure 23 'value' option page

2.3 Re-CONFIGURE the system

This option sets up system file names, peripheral and instrument HP-IB locations. This selection loads automatically on system bootup, and provides the 'default' software settings. Figure 24 shows this option.

```
                            SYSTEM CONFIGURATION


        1) SYSTEM FILE NAMES

                disc with data files  . SYSTEM

                default setup (C/N)      .. DEMO3
                default setup (C/I)      .. SAMPLE          1  .. System File Name
                                                            2  .. Peripheral Locations
        2) PERIPHERAL LOCATIONS                          3  .. Instrument Locations

                plotter address .. 705                      4  .. Store new configuration

                                                            R  .. Return to main menu
        3) INSTRUMENT LOCATIONS                                      select ..

                instrument HPIB interface .. 7
                3708 address ...... 8
                3781 (generator) .. 9
                3782 (detector ....10
```

Figure 24 System configuration option

The system works from either one or two HP-IB ports. One port (address 7) controls peripherals, and the second port (address 8) controls instruments. If there is only one port in the configuration, reset the instrument HP-IB interface to 7. This provides instrument and peripheral control from 1 port.

2.4 SELF-TEST of instruments

This option is a screen of text information giving references for instrument test procedures.

2.5 Perform a command SEQUENCE

The Command Sequence option is the most important enhancement in the HP 3708A demonstration software. This option takes commands from a file instead of a keyboard, and makes unattended or batch-mode operation possible. From the main menu level, press the following keys:

- Press key '5' to 'Perform a Command sequence'

- Press key '2' to 'change sequence name'

- Type in the name of the sequence displayed in the sequence directory and press <ENTER>

- Press key '1' to 'start the sequence'

From this point, all inputs come from the autosequence and not the keyboard. Figure 25 shows this option.

```
                    ┌─────────────────────────────────────────────┐
                    │         COMMAND SEQUENCING                   │
                    │                                              │
                    │      (c) 1986, 1987    Version  04.00/A      │
                    └─────────────────────────────────────────────┘

                                              SEQUENCE DIRECTORY
                                              (existing files)
            1  ......   Start the sequence
            2  ......   Change sequence name           ┌──────────┐
        <space>   ... Next file catalog                │  DEMO3   │
    <shift><space>.. Previous catalog                  │  DEMO2   │
                                                        │  DEMO1   │
            R  ......   Return to main menu             │          │
                                                        │          │
                selection ..                            │          │
                                                        │          │
                                                        │          │
        Current Sequence name:                          └──────────┘
```
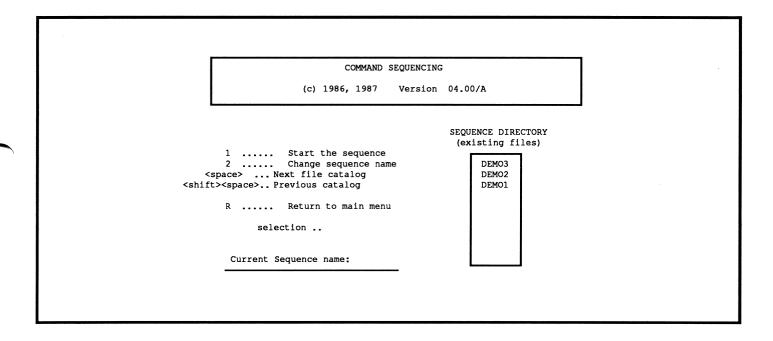
Figure 25 'Command sequence' option

2.6 Creating autosequence files

This section provides some in-depth information. The following details autosequencing file definition.

Autosequencing files are PASCAL text files created from the PASCAL environment. The system specifies the files seperately from the main NIMS environment. The following files show the autosequences derived for DEMO1, DEMO2 and DEMO3:

DEMO1 Autosequence

```
!I n _Demonstration autosequence - DEMO1.  Press <RETURN/ENTER>
!D _Loading C/N vs. BER measurements
1
!D _Retrieve a pre-stored measurement set-up from disc
2
3;
DEMO1

!D _Getting ready to execute measurement using configuration
R
1
!E 1
!D _Press <SPACE> to toggle, <A> to abort during measurement

!I n _We can now enter a curve comment.... Press <RETURN/ENTER>
DEMO1 - Measurement curve
DEMO1
R
!I n _Display curve to show radio is OK. Press <RETURN/ENTER>
4
1
!I n _The system will plot the latest curve. Press<RETURN/ENTER>
R
R
!I n _Press <RETURN/ENTER> to load a second curve.
3
4
!D _This is a theoretical performance curve.
L
DEMO1X
R
R
!I n _Press <RETURN/ENTER> to display second curve
4
1
!I n _Press <RETURN/ENTER> to superimpose curves.
1
1
R
!I n _Press <RETURN/ENTER> to change the Y axis to log(log BER)
!D _This allows checking of implementation margin of radio
5
```

```
_;
!I n _From here we can make other changes. Press <RETURN/ENTER>
!I n _Axis ranges can be changed. Press <RETURN/ENTER>
2
5
40
1e-11
1e-1
!I n _The grid can be turned off; Press <RETURN/ENTER>
3
N
!I n _and the X units can be changed. Press <RETURN/ENTER>
3
Y
2
10
20
1e-15
1e-1
!I n _Press <RETURN/ENTER> to plot curves on a plotter.
R
2
!D _You can plot on different paper sizes, change orientation etc.
_;
R
!I n _Please take the plot away with you. Press <RETURN/ENTER>
!D _This demo has shown you how powerful the software is...
1
!D _...for your testing needs. Thank you for your attention.
R
R
R
```

DEMO2 Autosequence

```
!I n _Demonstration Autosequence - DEMO2. Press <RETURN/ENTER>
!D _Loading C/N vs. BER measurements
1
!D _Retrieve a pre-stored measurement set-up from disc
2
3;
DEMO2

_
!D _Getting ready to execute a measurement using configuration
R
1
!E 1
!D _Press  <SPACE> to toggle, <A> to abort during measurement

_
```

```
!I n _We can now enter a curve comment.... Press <RETURN/ENTER>
DEMO2 - Measurement curve
DEMO2
R
!I n _Display curve to show radio is OK. Press <RETURN/ENTER>
4
1
!I n _The system will plot the latest curve. Press<RETURN/ENTER>
R
R
!I n _Press <RETURN/ENTER> to load a second curve
3
4
!D _This is a theoretical performance curve.
L
QPSK
R
R
!I n _Press <RETURN/ENTER> to display second curve
4
1
!I n _Press <RETURN/ENTER> to superimpose curves.
1
1
R
!I n _Press <RETURN/ENTER> to change the Y axis to log(log BER)
!D _This allows checking of implementation margin of radio
5
_;
!I n _From here we can make other changes. Press <RETURN/ENTER>
!I n _Axis ranges can be changed. Press <RETURN/ENTER>
2
5
40
1e-11
1e-1
!I n _The grid can be turned off; Press <RETURN/ENTER>
3
N
!I n _and the X units can be changed. Press <RETURN/ENTER>
3
Y
2
5
35
1e-15
1e-1
!I n _Press <RETURN/ENTER> to plot curves on a plotter
R
2
!D _You can plot on different paper sizes, chge orientation etc.
—
```

```
R
!I n _Please take the plot away with you. Press <RETURN/ENTER>
!D _This demo has shown you how powerful the software is...
1
!D _...for your testing needs.  Thank you for your attention.
R
R
R
```

DEMO3 Autosequence

```
!I n _Demonstration Autosequence - DEMO3. Press <RETURN/ENTER>
!D _Loading C/N vs. BER measurements
1
!D _Retrieving a pre-stored curve from disc
3
4
1
DEMO3
R
R
!I n _Press <RETURN/ENTER> to display first curve.
!D _From here, we can make changes ...... more to come
4
1
R
R
!I n _Press <RETURN/ENTER> to load a second curve
3
4
!D _This is a theoretical curve for a 16QAM modulation scheme
L
16QAM
R
R
!I n _Press <RETURN/ENTER> to display second curve
4
1
!I n _Press <RETURN/ENTER> to superimpose both curves
1
1
R
!I n _Press <RETRUN/ENTER> to change the Y axis to log(log BER)
!D _This allows checking of the radio implementation margin
5
_;
!I n _From here we can make other changes. Press <RETURN/ENTER>
!I n _Axis ranges can be changed: Press <RETURN/ENTER>
2
```

```
5
40
1e-11
1e-1
!I n _The grid can be turned off: Press <RETURN/ENTER>
3
N
!I n _and the X units can be changed. Press <RETURN/ENTER>
3
Y
!D _In addition, the plotting function can adjust plot sizes...
2
5
35
1e-15
1e-1
!I n _...for different requirements. Press <RETURN/ENTER>
5
_;
!I n _This software is very versatile... Press <RETURN/ENTER>
R
!I n _...and provides many customer benefits. Press <RETURN/ENTER>
R
!D _Thank you for your attention. End of demonstration.
R
```

The following procedure demonstrates how to create text files for use in the autosequencing program.

Instructions

Load the disc drive with DISC5 - the PASCAL 3.01 disc. Switch on the controller. The computer loads the system and a time and date prompt appears. Enter a time and date in the required format, and press <RETURN/ENTER> to terminate.

The following command level appears:

Command: Compiler Editor Filer Initialize Librarian Run eXecute Version ?

- Press 'E' to select the Editor

The 'No workfile found' prompt appears

- : Press <ENTER> for a new file

From this 'Edit' command level

- Press 'I' to insert

Enter a text file mimicking the keyboard keystrokes to form an autosequence. The example below illustrates this:

1
2
3
. . .

Keep the instructions one to a line. After each instruction, press <RETURN/ENTER> to terminate.

Construct your own text file. When finished:

- Press <EXEC> to retain the file, and
- 'Q' to 'Quit'
- Press 'W' to 'Write to a file name and Return'

At this point, remove the PASCAL 3.01 DISC 5 and replace with one of the new software system discs (DISCS 1 to 4)

Enter the filename title desired for this 'new sequence'. It may be up to 6 characters long (alphanumeric), then must include _SQ ajoined to it (notice capital letters). The volume label (SYSTEM:) must also preceed it :

SYSTEM:XXXXXX_SQ

- Press <RETURN/ENTER>

The system now writes the new text file onto the disc.

- Press 'E' to exit the editor

This brings you back to the main PASCAL command level.

The system now recognizes the text file as a new autosequence, and the user runs this in the normal way.

2.7 Additional autosequence features

The autosequencing feature also performs additional functions:

(a) The system provides several error reporting conditions. Errors occur from incorrect sequence specification or system errors. All error types are 'fatal' and cause sequence termination and return the system to normal interactive mode. Autosequencing deals with this in several ways:

Level 1- 'Press on'. Report the error in the sequence window, then carry on with the rest of the sequence. (Ignore the error)

Level 2- 'Stop Here'. Report the error, then wait for a proceed command from the user before terminating the sequence and returning control to the user at the point of error.

Level 3- 'Abort'. Immediately jump back to the sequence manager to report the error and prepare to restart another sequence.

Level 4- 'Ask'. Stop and ask which of the above responses to use.

The sequence notification for this is !e x - where x is 1,2,3 or 4. Notice pre-stored autosequences DEMO1 and DEMO2 use this.

(b) Display a sequence message. Shows a text message in the sequencer window line. The system shows progress messages to the user.

The sequence notification for this is !D _ . . . . text . . . . DEMO1, DEMO2 and DEMO3 all use this. **NOTE:** The system permits a maximum of 80 characters per line.

(c) The user gives operation instructions from the keyboard as if in the normal operating mode. This is different to the data input function, where data is interchanged only in the sequencer window line.

The sequence notification for this is !U.

(d) Input data to the sequencer. The system allows data storage of up to 8 variables with this command. A text prompt can be included for the data, with the cursor put directly after the text.

The system accepts data of any type or format. Length restriction is only by available space left after the prompt in the sequence window.

Sequence notification for this is !I. An example is shown below:

!I r Please enter the radio Serial Number:_

r is the variable

(e) Substitute variable data into an operation. Previously stored data in the sequence variables can be recalled and substituted into other operations. The system also allows substring selection of the full data, and performs this in the command input operations or the display functions. Any number of substitutions may appear in an operation, up to a limit of 80 characters.

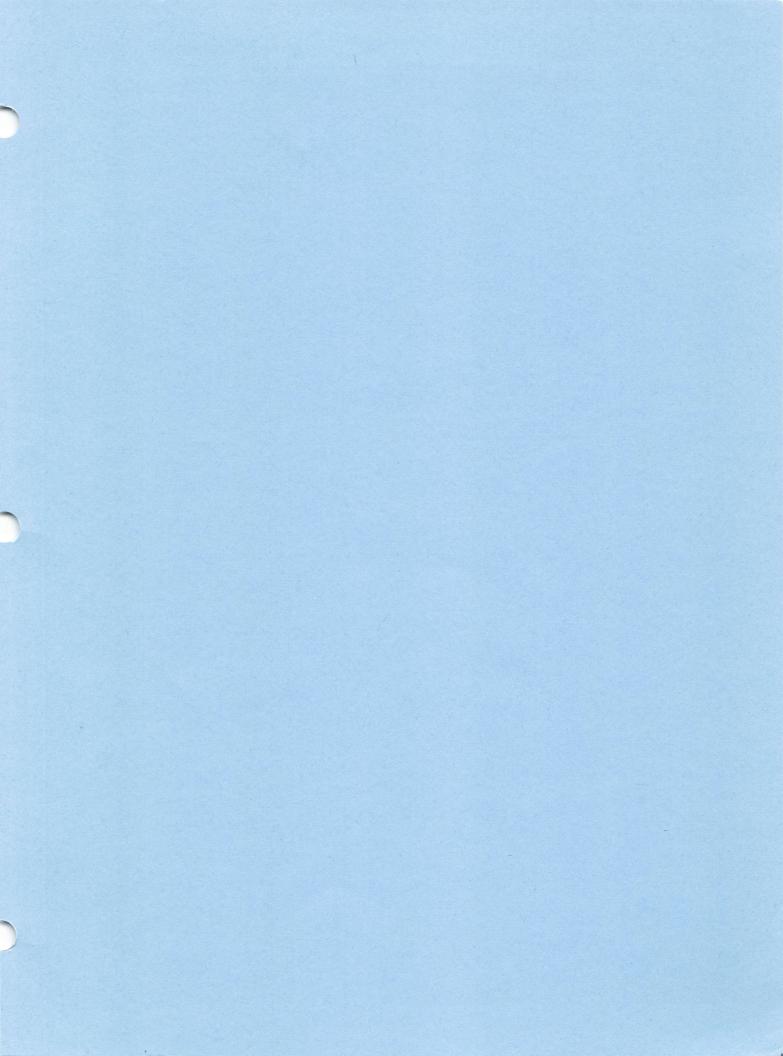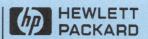Sequence notification for this is shown by example:

!S R(2,4)

R - any variable name
2 - a typical start position
4 - typical variable length

Other things to note:

- The system allocates a space by specifying an underscore (_). The autosequence uses this character for a space in plot axis selection etc, and where text messages need leading or trailing spaces.

- The system accepts a <RETURN/ENTER> action either as a <RETURN/ENTER> when specifying text in the autosequence definition, or as ';' operation delimiters. So the system treats these expressions as equivalent:

$$
\begin{array}{ccc}
1 & & 1;2;3 \\
2 & \& & \\
3 & &
\end{array}
$$

- The '*' character as a first character in a sequence line is a no-action line. To aid sequence file readability, these may be used for specifying comment lines between operations.

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